

BATH TREATMENTS MODELLING REPORT

Caolas Finfish Pen Site, Loch Portain, North Uist

Prepared for

Loch Duart Ltd

Badcall Salmon House

Scourie

Sutherland

IV27 4TH



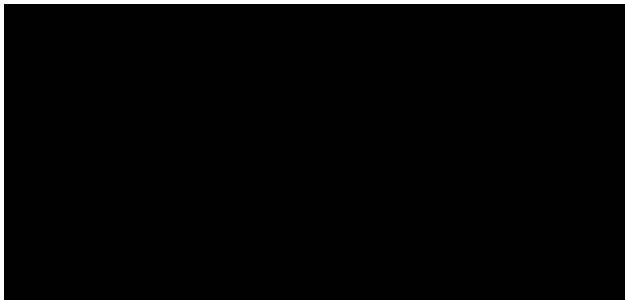
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Quality Assurance

The data presented within this document have undergone a quality assurance review which follows established TransTech Ltd procedures. The information and results presented herein constitute an accurate representation of these data.

Document Details

Author:



Issue Date: 3 July 2023

Issue No: 2023v1

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List of Abbreviations

ADCP	Acoustic Doppler Current Profiler
CD	Chart Datum
EQS	Environmental Quality Standards
GMT	Greenwich Mean Time
mCD	Metres below Chart Datum
SEPA	Scottish Environment Protection Agency

EXECUTIVE SUMMARY

This report has been prepared to meet the requirements of the Scottish Environment Protection Agency (SEPA) for the consent to use chemical bath treatments against sea lice for salmonids held in marine pens. The modelling reported herein is for the proposed modification of the Caolas pen site (i.e., twelve 100 m circumference pens in a 60 m x 60 m mooring grid).

Bath Auto was used to determine the concentration of the chemicals Azamethiphos (Salmosan), Deltamethrin (Alphamax) and Cypermethrin (Excis) that can be used at the modified Caolas site.

The maximum permissible quantity of Azamethiphos that can be used in a 3 hour period was predicted to be 130.2 g, at a treatment regime of 1.0 pen in 3 hours, at a net depth of 1.70 m. However, the long term model did not iterate to a compliant pass and given that its results override those of the short term model in terms of the BathAuto predictions Azamethiphos cannot be used at the site.

The maximum quantity of Deltamethrin permissible in a 3 hour period was predicted to be 5.8 g at a treatment regime of 2.0 pens in 3 hours for a net depth of 1.85 m.

The maximum quantity of Cypermethrin permissible in a 3 hour period was predicted to be 15.6 g at a treatment regime of 2.0 pens in 3 hours for a net depth of 1.95 m.

1. INTRODUCTION

This report has been prepared to meet the specific requirements of SEPA for the assessment of applications for consent to use bath treatments against sea lice in marine salmonid farms. The bath treatments must comply with Environmental Quality Standards (EQS) that are in place to protect the marine environment.

Bath treatments, where the fish are physically immersed in a diluted solution of a particular chemical, require dispersion modelling (Bath Auto) to predict concentrations of the chemical in the water column at specified periods after the treatment has been completed.

The methods described in this report closely adhere to those set out in Annex G⁽¹⁾ of the SEPA Fish Farm Manual, and the results are reported to satisfy consent application requirements.

2. CAOLAS SITE INFORMATION

Site details

Site name:	Caolas	
Distance to shore:	0.098 km	(from pen edge to MLWS at closest point)
Width of straight:	0.416 km	(from pen edge to MLWS at narrowest point)
Distance to head:	2.339 km	(from pen edge to MLWS at shortest point)
Average water depth for 1 km ² area:	15.73 mCD	(from previous BathAuto modelling at site)

Pen group details

Group centre position:	94829.2 E, 869326.4 N (as per NewDEPOMOD report for modified site)
Number of pens:	12
Pen group configuration:	2 x 6
Pen dimensions:	100 m circumference circle
Grid size (x by y):	60 m x 60 m grid
Working depth:	12.0 m
Peak biomass:	1720.0 tonnes
Peak stocking density:	15.01 kg/m ³
Pen group orientation:	138.0°

3. HYDROGRAPHIC DATA

The hydrographic data for the sub-surface cell are summarised below. The data were analysed using SEPA's HGdata_analysis_v7.xls (version 7.11) tool. Further details on the Acoustic Doppler Current Profiler (ADCP) deployments are available in reports previously submitted to SEPA, titled:

- "CLP_2023v1_Hydrographic_Report.pdf", dated 3 May 2023, and
- "CLP_2023v1_ND_Modelling_Method_Statement.pdf" also dated 3 May 2023.

Current meter position:	94747.2 E, 869226.7 N (weighted mean of deployments)
Distance from group centre:	129.1 m
Weighted mean depth for deployments:	27.87 mCD
Sub surface cell height above bed:	25.02 m
Duration of record:	90 days (22/11/22 16:11:57 to 20/02/23 16:11:57 GMT)

Mean speed	0.042 m/s
Residual parallel (U)	0.008 m/s
Residual normal (V)	-0.001 m/s (BathAuto requires entry as +ve number)
Tidal amplitude parallel (U)	0.053 m/s
Tidal amplitude normal (V)	0.044 m/s

4. BATH TREATMENT MODELLING

SHORT TERM MODEL

Using the results from the data analysis of the sub-surface current meter cell, the short term bath treatment model was run and the EQS compliance for the chemical treatments, Azamethiphos, Deltamethrin and Cypermethrin, were predicted.

Results of Short Term Model:

Treatment	Permissible quantity	Pen treatment depth*	% net depth	No. of Pens treatable
Azamethiphos in 3 hrs	130.2 g	1.70 m	14.2	1.0
Deltamethrin in 3 hrs	5.8 g	1.85 m	15.4	2.0
Cypermethrin in 3 hrs	15.6 g	1.95 m	16.3	2.0

* Treatment depth can be varied. The depths above show the number of pens treatable at an example net depth.

LONG TERM MODEL

For the purposes of the long term (72 hour) dispersion model for Azamethiphos, the receiving water was classified as a straight.

The results of the long term model override those of the short term and therefore in terms of the BathAuto predictions Azamethiphos cannot be used at the site.

The Bath Auto spreadsheet is provided along with this document and is also shown in appendix A.

FILES ACCOMPANYING THIS REPORT

- Model and results contained within:
CLP_2023v1_BathAuto_v5.

FILES THAT HAVE BEEN PREVIOUSLY SUBMITTED TO SEPA

- Hydrographic report and associated SEPA validated datasets which were used for the modelling:
CLP_2023v1_Hydrographic_Report.pdf, 3 May 2023.
S - hgdata_analysis_v7.xls (90-day dataset).
- Method statement for TransTech's modelling of the Caolas site:
CLP_2023v1_ND_Modelling_Method_Statement.pdf, 3 May 2023.

REFERENCES

- (1) Annex G. Models for assessing the use of chemicals in bath treatments. v2.2. Scottish Environment Protection Agency. 31 October 2008.

APPENDIX A

CLP_2023v1_BathAuto_v5.xls (Version 5.1)

Site Data																									
Site name:	Caolas (12 x 100m Circles as per ND Mod)	<div style="border: 1px solid black; padding: 5px; background-color: #f0f0f0;"> <p style="margin: 0;">Run Bath Auto</p> <p style="margin: 0; color: red;">Do 3 things before pressing this button:</p> <p style="margin: 0; color: red;">1: Read the Brief User Guide</p> <p style="margin: 0; color: red;">2: Read all the cell notes on this sheet</p> <p style="margin: 0; color: red;">3: Check all input data are correct</p> </div>																							
Company:	Loch Duart Ltd																								
Modelled By:	Garret Macfarlane																								
Site NGR:	94829 E, 869326 N																								
Current meter NGR:	94747 E, 869227 N																								
Loch Data		<div style="border: 1px solid black; padding: 5px; background-color: #f0f0f0;"> <p style="margin: 0; color: blue;">Transfer values to be reported to the blue cells</p> </div>																							
Loch/Strait/Open water:	Strait	debug mode: <input checked="" type="radio"/> ON <input type="radio"/> OFF																							
Loch area (km ²):		<div style="border: 1px solid blue; padding: 5px; background-color: #e0e0ff;"> <p style="margin: 0; color: blue; font-weight: bold;">paste these values to the Marine_sum workbook</p> <table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th></th> <th style="background-color: #e0e0ff;">Azamethiphos</th> <th style="background-color: #e0e0ff;">Cypermethrin</th> <th style="background-color: #e0e0ff;">Deltamethrin</th> </tr> </thead> <tbody> <tr> <td>3 hour proposed treatment value [g]:</td> <td style="background-color: #e0e0ff;">130.2g</td> <td style="background-color: #e0e0ff;">15.6g</td> <td style="background-color: #e0e0ff;">5.8g</td> </tr> <tr> <td>24 hour proposed treatment value [g]:</td> <td style="background-color: #e0e0ff;">0.0g</td> <td style="background-color: #e0e0ff;"></td> <td style="background-color: #e0e0ff;"></td> </tr> <tr> <td>No. of cages treatable in 3 hours:</td> <td style="background-color: #e0e0ff;">1.0</td> <td style="background-color: #e0e0ff;">2.0</td> <td style="background-color: #e0e0ff;">2.0</td> </tr> <tr> <td>No. of cages treatable in 24 hours:</td> <td style="background-color: #e0e0ff;">0.0</td> <td style="background-color: #e0e0ff;"></td> <td style="background-color: #e0e0ff;"></td> </tr> </tbody> </table> </div>					Azamethiphos	Cypermethrin	Deltamethrin	3 hour proposed treatment value [g]:	130.2g	15.6g	5.8g	24 hour proposed treatment value [g]:	0.0g			No. of cages treatable in 3 hours:	1.0	2.0	2.0	No. of cages treatable in 24 hours:	0.0		
	Azamethiphos					Cypermethrin	Deltamethrin																		
3 hour proposed treatment value [g]:	130.2g					15.6g	5.8g																		
24 hour proposed treatment value [g]:	0.0g																								
No. of cages treatable in 3 hours:	1.0					2.0	2.0																		
No. of cages treatable in 24 hours:	0.0																								
Loch length (km):																									
Distance to head (km):	2.34																								
Distance to shore (km):	0.10																								
Width of Strait (km):	0.42																								
Average water depth (m):	15.73																								
Flushing time (days):																									
Cage Data																									
# of cages:	12																								
Cage shape:	Round																								
Diameter/Width (m):	31.8																								
Working depth (m):	12																								
Stocking density (kg/m ³):	15.01																								
Treatment																									
No. of cages possible to treat in 3 hours:	0.00																								
Initial Treatment Depth (m):	2.5																								
Treatment Depth Reduction Increment (m):	0.1																								
Hydrographic data analysis		Excursion		Cage details																					
Mean current speed (m/s):	0.042			Single cage area (m ²):	795.77																				
Residual Parallel Component U (m/s):	0.008	2.07km		Total cage area (m ²):	9549.30																				
Residual Normal Component V (m/s):	0.001	0.26km		Treatment depth (m):	0.10																				
Tidal Amplitude Parallel Component U (m/s):	0.053	0.76km		Single cage volume (m ³):	19098.59																				
Tidal Amplitude Normal Component V (m/s):	0.044	0.63km		Total cage volume (m ³):	954.93																				